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GROUND WATER AND ECOSYSTEMS RESTORATION RESEARCH

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Stable Isotopes and Tracers to Evaluate Source and Movement of Ground Water Contaminated by Nitrate

Project Type

This is an EPA Region 4 Regional Applied Research Effort (RARE) project established between EPA's Ground Water and Ecosystem Restoration Division (GWERD) (Steve Hutchins, Project Officer) and EPA Region 4 (Lee Thomas, Project Officer). Isotope analyses were conducted under Interagency Agreement DW14922005 with the U.S. Geological Survey (USGS) (Carol Kendall, Principal Investigator).

Project Period

July 1, 2005 to present

Project Summary

EPA Region 4 investigations have shown several private water supply wells to be contaminated with high concentrations of nitrate; the wells are near animal feeding operations, including swine farms, poultry farms, and dairy farms. In the rural settings where the animal feeding operations and the private water supply wells are located, there are multiple potential sources of nitrogen. In addition to the animal feeding operations, some of the more common potential sources of nitrogen include over-fertilized crop fields, improperly functioning septic tanks, and naturally occurring nitrogen.

In order to address the private well contamination, a determination must be made regarding the source of the nitrogen. Extensive research has been conducted regarding the isotopic signature of swine waste and commercial fertilizer. Specifically, the δ15N isotope has been used by EPA Region 4 with other ground water data to identify the source of nitrate contamination near swine farms. However, there is little information regarding the isotope signature of poultry and dairy farms.

The Water Management Division proposed a research effort to provide this much-needed data on the isotopic composition of poultry and dairy farms. EPA Region 4 would locate eight to ten specific sites in the southeastern United States for data collection. Field investigations would be conducted by EPA Region 4's Science and Ecosystem Support Division (SESD), based on a work plan developed with GWERD. Isotopes to be considered would include δ15N and δ18O of nitrate, and δ18O of water. Isotope data would be analyzed and evaluated by the USGS Research Lab in Menlo Park, California. In addition to the collection of isotopes, the field investigation would include collection of samples for analysis of nutrients and other water quality indicators by SESD. Also, the investigation would include collection of samples for analysis by GWERD for inorganic tracers, including metals, cations, and arsenic anions. GWERD would also analyze samples for environmental estrogens expected to be

present from poultry operations. Media sampled would include private water supply wells, ground water, and potential sources. EPA Region 4 would also use a Geoprobe to take subsurface ground water samples in areas of interest and to fill data gaps.

Unfortunately, problems were encountered in locating and gaining access to enough suitable sites for study. Three poultry operation sites in the southeastern United States were selected, although access was granted only to the application fields within the facility but not the poultry barns themselves; source material could not be obtained. A fourth poultry operation in the southern United States was also selected; this was a wet operation (lagoons, not dry litter), and site access was granted. Because of limited site access and other logistics, only a limited number of water samples could be obtained from each site. All field work and analyses have now been completed and a report is pending.

Products

An EPA report is in progress.

Project Officer

Steve Hutchins

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